COMBATING TERRORISM TECHNOLOGY SUPPORT OFFICE: TECHNICAL SUPPORT WORKING GROUP

Enabling Technologies for Combating Terrorism
NDIA

Mission and Objectives

- **Mission:** Conduct the U.S. national interagency research and development program for Combating Terrorism through rapid research, development, and prototyping.
- **Objectives:**
  - Provide interagency forum to coordinate R&D requirements for combating terrorism
  - Sponsor R&D not addressed by individual agencies
  - Promote information transfer
  - Influence basic and applied research

Oversight
DOS

Executive
Program Direction
ASD (SO/LIC)

Technical Chairs
DoD DHS DOE FBI

COORDINATOR FOR COUNTERTERRORISM

PROGRAM MANAGEMENT

Combating Terrorism
Technology Support Office
DoD

MULTI-AGENCY MEMBER SUBGROUPS

- **Chemical, Biological Radiological, Nuclear Countermeasures** — **FBI/IC**
- **Improvised Device Defeat** — **FBI**
- **Investigative Support & Forensics** — **USSS/USPS**
- **Surveillance, Collection & Operations Support** — **IC**
- **Training Technology Development** — **TBD**
- **Explosives Detection** — **TSA**
- **Infrastructure Protection** — **DoD/FBI**
- **Physical Security** — **DoD**
- **Tactical Operations Support** — **DoD**
- **VIP Protection** — **USSS**

TSWG Membership

Department of Defense

Defense Computer Forensics Laboratory
Defense Cyber Crime Institute
Defense Intelligence Agency
Defense Logistics Agency
Defense Polygraph Institute
Defense Threat Reduction Agency
Joint Chiefs of Staff
National Reconnaissance Office
National Security Agency
Office of the Assistant Secretary of Defense, Special Operations and Low-Intensity Conflict
Office of the Under Secretary of Defense, Acquisition, Technology and Logistics
Pentagon Force Protection Agency
U.S. Central Command
U.S. European Command
U.S. Joint Forces Command
U.S. Special Operations Command
U.S. Air Force
- Air Combat Command
- Air Force Research Lab
- Electronic Systems Command
- Force Protection Battle Lab
- Force Protection Systems Program Office
- Office of Special Investigations
- Surgeon General

U.S. Army
- 52nd Ordnance Group
- Chemical School
- Corps of Engineers
- Criminal Investigations Command
- Forces Command
- Maneuver Support Center
- Medical Research Institute for Infectious Diseases
- Natick Research, Development and Engineering Center
- National Ground Intelligence Center
- Soldier and Biological Chemical Command, Edgewood
  - Chemical Biological Center
- Tank-Automotive and Armaments Command
- Technical Escort Unit`

Department of Defense (cont)

U.S. Marine Corps
- Chemical Biological Incident Response Force
- Critical Infrastructure Protection

U.S. Navy
- Joint Program Office-Special Technology Countermeasures
- Naval Air Warfare Center
- Naval Criminal Investigative Service
- Naval Explosives Ordnance Disposal Tech Div
- Naval Facilities Engineering Service Center
- Special Warfare Center

Department of Agriculture

Animal and Plant Health Inspection Service
Cooperative States Research, Education and Extension
- Service

Food Safety and Inspection Service
Forest Service

Department of Commerce

National Institute of Standards and Technology
- Office of Law Enforcement Standards

Department of Energy

National Nuclear Security Administration
Office of Energy Assurance
Office of Security

Department of Health & Human Services

Food and Drug Administration

Department of Homeland Security

Border and Transportation Security Directorate
Federal Emergency Management Agency
Federal Law Enforcement Training Center
Federal Protective Service
National Infrastructure Protection Center
Office of Domestic Preparedness
Science and Technology
Transportation Security Administration
Land and Maritime Security
U.S. Coast Guard
U.S. Secret Service
- Criminal Investigations Division

Department of Homeland Security (cont)
- Forensic Services Division
- Protective Security Division
- Special Services Division
- Technical Security Division

Department of Justice

Bureau of Alcohol, Tobacco, Firearms & Explosives
Drug Enforcement Administration
Federal Bureau of Investigation
- Bomb Data Center
- Hazardous Materials Response Unit
- Hostage Rescue Team
- Weapons of Mass Destruction Operations

Federal Bureau of Prisons
National Center for Forensic Science
National Forensic Science Technology Center
National Institute of Justice
U.S. Marshals Service

Department of State

Bureau of Diplomatic Security
Office of the Coordinator for Counterterrorism
Overseas Building Operations

Department of Transportation

Federal Aviation Administration
Intelligence and Security
Office of Information Services
Volpe National Transportation Systems Center

Independent Agencies

Environmental Protection Agency
Federal Reserve Board
General Services Administration
Intelligence Community
InterAgency Board
National Aeronautics and Space Administration
Nuclear Regulatory Commission
Office of Science and Technology Policy
Senate Sergeant at Arms
Supreme Court of the United States
U.S. Capitol Police
U.S. Postal Inspection Service

The Research Economy

Combating Terrorism Value

DOE OS /
NSF /
ONR/ARO/

DARPA -- Very High Risk /
High Payoff Breakthroughs.

The Scientific Wealth of Nations:

Patience Curve

The "Invisible Hand" meets the
"Endless Frontier"

Value

Cost/T

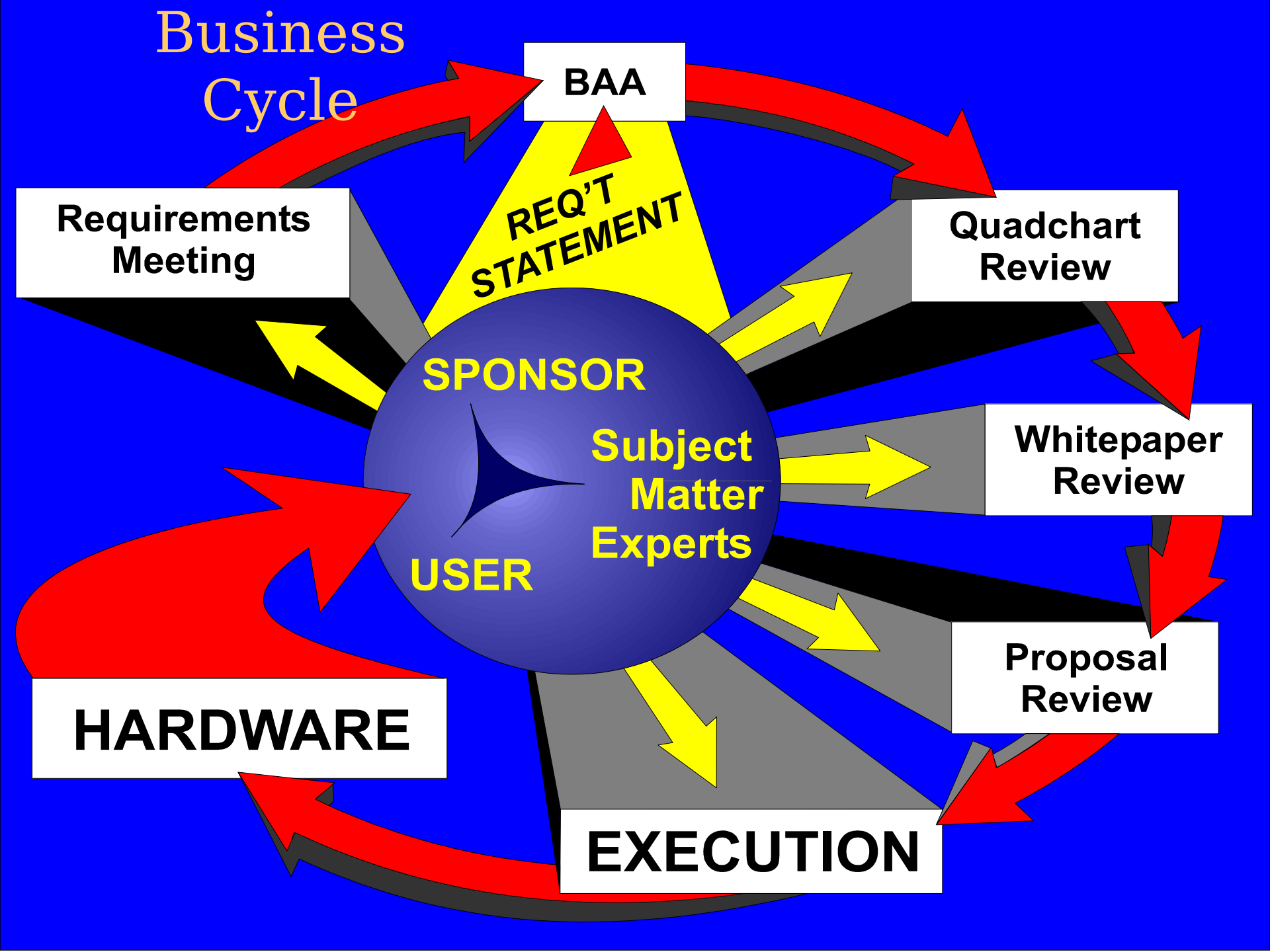
S

DTRA, HSARPA,NASA, NI
and **DOE NNSA** -- Large Scale
and Long Development / Approval Process

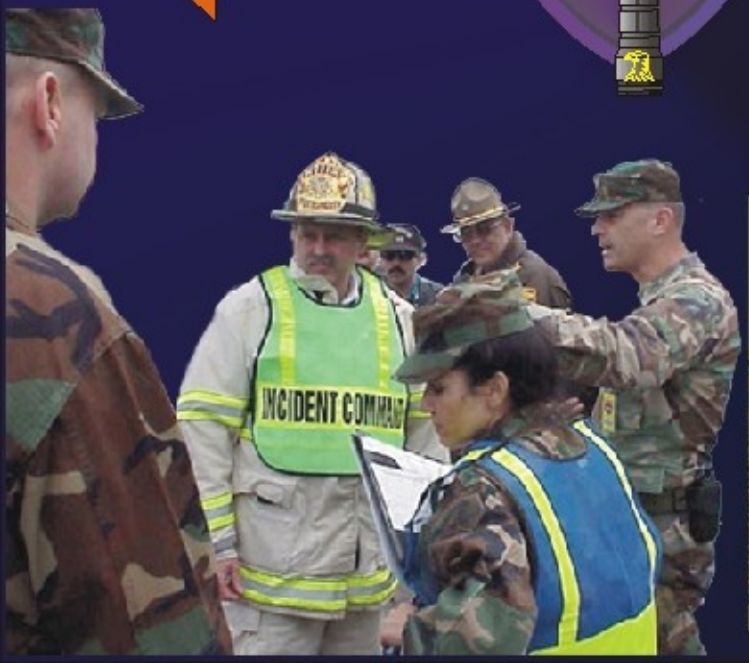
TSWG -- Rapid Prototy n:
Risk and Uncertain M s
Commercial Deve

Commercial Development / Product t .

Cost/Time/Risk


Business Cycle
BAA
REQ'T STATEMENT
Requirements Meeting
Quadchart Review
SPONSOR
Subject Matter Experts
USER
Whitepaper Review
Proposal Review
HARDWARE
EXECUTION

TSWG Interface with the Basic Science Community



Tools in the Hands of Users

Escape Mask Testing

- Escape masks were evaluated at ECBC for filter performance, materials, and physiology and fit.
- Quick2000: 200,000 masks fielded to DOD, DOS, Capitol Police.
- MSA: meets CB protection criteria.
- ILC Dover SCape: 50,000 masks fielded to FBI, GAO, ACE, DOJ, NSA, USMC

Chemical/Biological Simulant Training Kit

- ~350 CBR simulant kits sold to the interagency community.
  - » Users include: CBIRF, DHS, DOE, NASA, NGIC, NIST, TEU, TSA, USAF, USCP, USNORTHCOM, USPIS, and local fire and police departments.

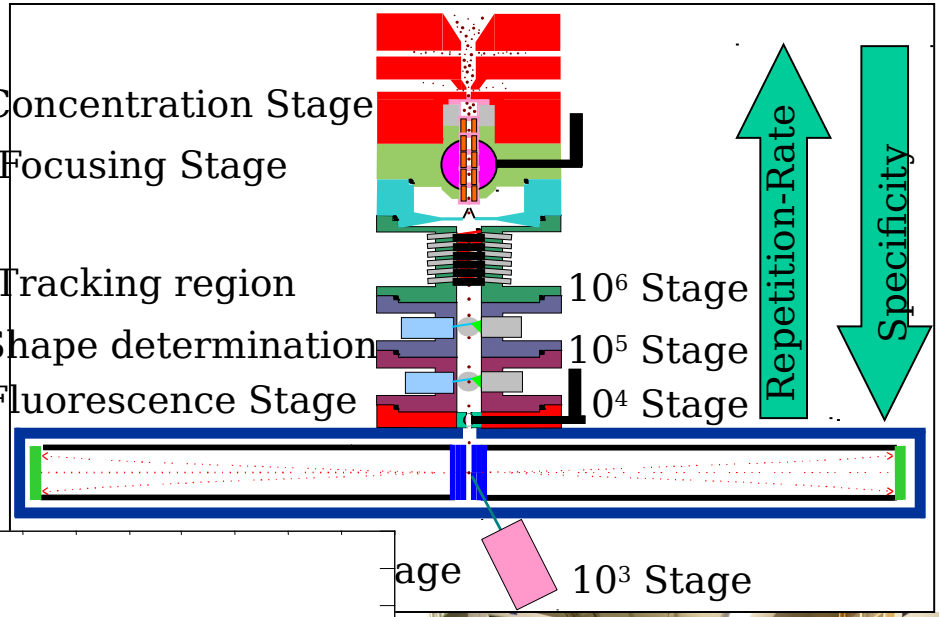
- Explosives simulant prototype kits.
  - » Kits available to interagency community in ~ 6 months. >800 kits pre-ordered: FBI Bomb Squads (450 kits), TSA (200 kits), Military EOD groups, and state/locals.

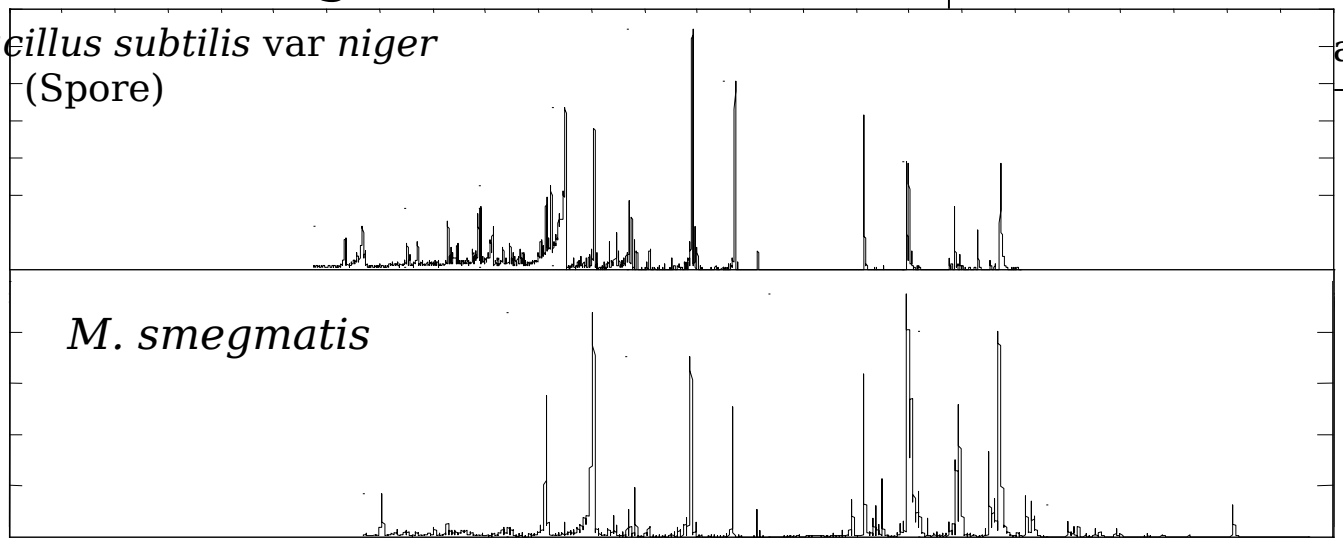
Low Cost Robots

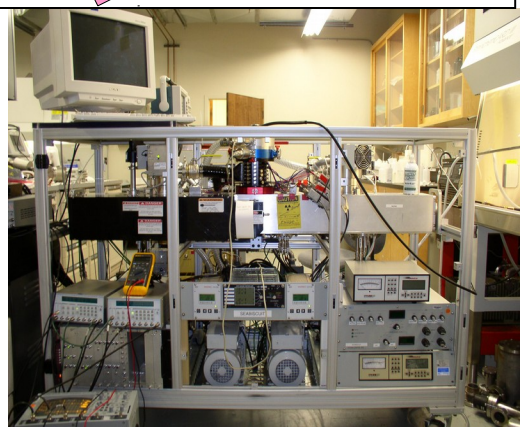
- Robot for low cost DoD option
- Used by local Bomb Disposal Teams

Real-Time Bioaerosol Detection and Identification

Mass spectral identification of individual spores "on the fly."
DARPA and TSWG funding.







Electrostatic Decontamination

- Dual-use meeting civilian, military and industrial uses.

Operational Shortfalls - Overview

- Chemical, biological, radiological, nuclear and explosives forensics
- Non-intrusive detection of chemical, biological and explosives
- Standoff chemical, biological, radioactive materials and explosives detection
- Canine detection of explosives and other materials
- Chemical and biological personal protective equipment
- Remote deception detection
- Through structure imaging
- Chemical and biological decontamination of civilians

Operational Shortfalls - Overview

- Digital data & evidence analysis
- Cyber location/analysis
- Tagging and tracking
- Infrastructure network linkage analysis
- Epidemiological modeling
- Diagnostic imaging in the field
- Light weight body armor
- Sniper detection
- Entry point screening of vehicles
- Blast effects analysis and mitigation

S&T Shortfalls

- S&T Needs are Multi-Disciplinary
- Requirement Areas
  - Chemistry/Materials Science
  - Computer and Information Sciences
  - Physics /Applied Physical Sciences
  - Engineering Sciences
  - Biochemistry/Genetics/Microbial Biology
  - Physiology

Chemical, Biological, Radiological, Nuclear or Explosives Forensics

- Terrorists working with CBRNE must be identified. Forensically link terrorists in custody to work with toxic chemicals, biological agents, explosives or radiological devices.
  - Biochemical and/or biophysical changes resulting from intermittent less than lethal exposure to chemical warfare agents; ionizing radiation radiological dispersion devices; biological warfare agents; nuclear or explosive devices.
    - Expedient field assays and definitive laboratory protocols.

Matrices of interest include clothing, hair, skin, blood, bodily wastes, teeth and bone.

Changes must be sufficiently stable to be detectable days to weeks after the individual's exposure.

Non-Intrusive Chemical, Biological and Explosives Detection

- Detection/identification of explosives, chemical warfare agents and biological agents at short standoff or limited contact/access.
  - Analysis of bulk suspect materials in solid or liquid form.
    - Penetration of various packaging materials.
    - Accurate assessment in cluttered environment.
    - Rapid data acquisition, integration and processing.
    - Improve signal to noise and suppress false positives.
  - Integration of spectroscopic results with literal images.
  - Real time subtraction/suppression of chemical, physical, or magnetic noise.

Standoff and Non-contact Chemical, Biological and Explosives Detection

- Detection of explosives, toxic chemicals and hazardous biological agents at a distance at PPB and below in a high background environment.
  - Active and/or passive spectroscopic methods across all spectral bands.
    - Gas phase emanations or surface contamination.
    - Rapid data acquisition, integration and processing.
    - Multiple spectral band instrumentation and data fusion to improve signal to noise and suppress false positives.
  - Integration of spectroscopic results with literal images.
  - Background signal identification, measurement and subtraction/suppression in real-time.
  - Other than electromagnetic phenomena

Canine Detection of Explosives and other Materials

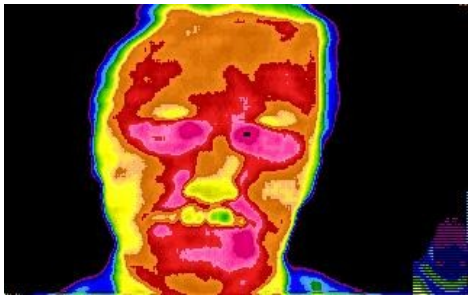
- Used extensively to detect explosives, drugs, and currency. Benchmark and improve sensitivity, selectivity, and reliability.
  - Genetic and psychological (training/handler interaction) contributions to canine olfactory detection performance.
    - Quantitative Trait Loci analysis of canine olfactory performance (what makes a good nose).
    - Genomics contribution to breeding program to improve performance and reduce washout rate.
    - Genetic engineering to improve physiological/olfactory performance minimize genetic defects.
  - Physiological basis of play versus food rewards on performance.
    - Impact of food rewards on olfactory acuity through interaction of food intake-related neuropeptides (satiation).

Diagnostic Imaging in the Field

- Field analysis of improvised explosive, chemical or biological dissemination devices depends on two-dimensional portable x-ray systems.
  - Improve resolution and speed of single-sided x-ray image capture.
  - Tomographic 3-D image reconstruction based on a constrained sample set – small number of images at limi number of angles.

Remote Deception Detection

- Border and other security officers have limited probability of detecting and acting on deceptive behavior with direct security implications.
  - Laser doppler vibrometry/Thermal imagery analysis
    - Statistical distribution of deceptive physiological responses across the population – age, ethnic and cultural groups, health status, psychological profiles and environmental factors.
    - Identify any population subgroups that would consistently register as deceptive.
    - Rapid image processing and analysis.



Through Structure Imaging

- Reduce uncertainty during covert and overt surveillance by locating and monitoring persons inside a structure, tunnel or rubble to discriminate between terrorists and hostages, and distinguish among living, injured and dead.
  - Penetrate all types of construction materials.
  - Identify, locate and track presence/movement of all people in areas under surveillance at sufficient spatial and time resolution to provide tactical information to users.
  - Signal Processing to determine material composition, thickness; screen out confusing returns (clutter, etc.) and display real-time literal images conforming to the area under investigation.

Chemical and Biological Personal Protective Equipment

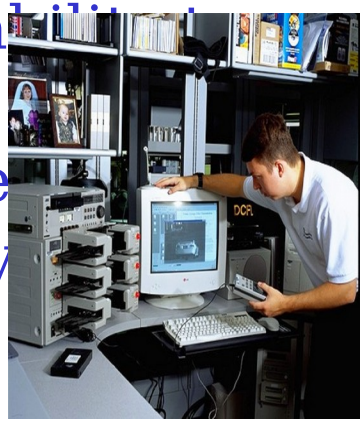
- Current protective equipment reduce mobility, degrade tactile sensitivity, place a high heat stress burden on the wearer and cannot be worn during heavy rescue operations.
  - Selectively permeable materials to permit evaporative heat loss while preventing entry of a wide range of military chemical agents and toxic industrial chemicals and biological warfare pathogens.
    - Tough materials capable of use in the field.
    - Able to be decontaminated or disposable.
  - Sorbent or reactive filter materials to reduce breathing resistance, space and weight of gas mask canisters.
    - Effective against a broad spectrum of organic, inorganic and organo-metallic gases/aerosols.
    - High loading factor with minimal off-gassing.
    - Benign reaction products.

Chemical and Biological Personnel Decontamination

- Current decontamination technologies were designed for worst case scenario use by trained, physically fit, English speaking and middle age military personnel with protective equipment.
  - Reactive chemicals to quickly neutralize chemical before skin adsorption causing adverse health effects or prevent infection following contamination of skin with pathogens.
    - Rapid acting reagent with broad spectrum of action.
    - Advanced toxicity screening methods to identify chemicals that are environmentally benign, eye-safe, skin-safe, and have low oral/inhalational toxicity.
  - ong term health effects of the toxic exposure across he full diversity of the population and identify treatments to prevent or mitigate.

Digital Data Evidence Analysis

- The volume of digital data of potential evidentiary value in a terrorism case can be overwhelming and without effective analysis tools critical linkages may be missed.
  - Effective data mining tools across diverse database structures, formats and naming conventions.
  - Complex pattern analysis tools effective across multiple datasets and time with the a
    identify and test linkages.
  - Wireless device (pager and cell phone
    stand-off covert download technology

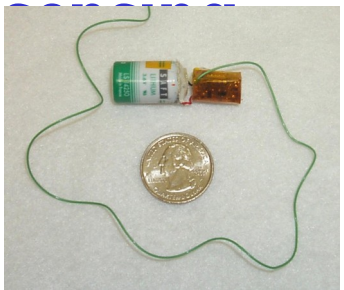


Cyber Location/Analysis

- Terrorist exploitation of the relative anonymity and ambiguity in location of cyberspace to hide their planning and activities complicates real-time tactical reaction and post-event investigations.
  - Active query or signature analysis of current and archived voice and data communications (line, internet, and satellite) from to geographic

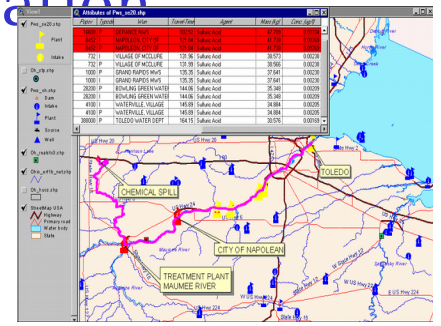
Tagging and Tracking Technology

- Current tagging and tracking tools for use against individuals, vehicles, facilities and packages are limited in range, subject to compromise, risky to put in place, and expensive to monitor.
  - Active, query-response and passive tagging and tracking tools with very high signal to noise ratio detectable at a distance across diverse of natural and man-made environments.
  - New materials with unique signatures over a wide spectral range requiring special sensing techniques to preclude compromise.



Infrastructure Network Linkage Analysis

- Attacks on complex interconnected infrastructure (communications, natural gas, electric, water and transportation) networks may create more serious unanticipated second order effects than the primary damage.
  - Continental-scale network analysis tools accommodating interdependencies between networks. Conduct vulnerability calculations to identify critical nodes and paths requiring protection or redundant paths to ensure continuous service and damage mitigation



Epidemiological Modeling

- Macro- and meso-scale models of bioterrorism human, animal and plant disease spread. Projections (next 1-7 days) needed to support implementation of protective measures and efficient allocation of limited response resources.
  - Macro-scale epidemiological modeling integrating:
    - Susceptible and carrier population and pathogen distribution.
    - Environmental factors (weather, land use, hydrologic).
    - Transportation infrastructure and patterns.
  - Response planning tools to efficiently allocate resources.
  - Command and control links across multiple echelons.

Lightweight Body Armor

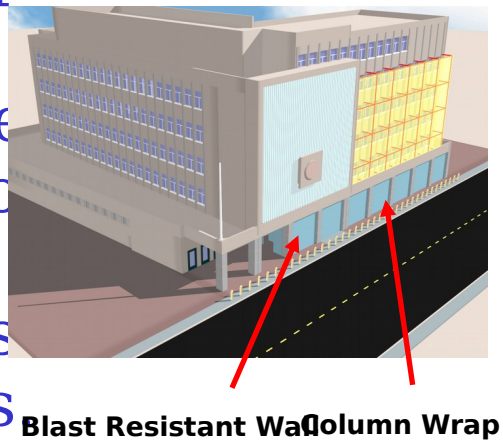
- Body armor needs to be lighter, more flexible and conform to various body forms (Male and Female), while providing protection against threat ballistic projectiles for National Institute of Justice protection Level IIIA and IV standards.
  - Low density flexible materials with very high high tensile strength and toughness to counter the rifle projectile threat.
  - Optimize rapid impact energy distribution and dissipation in the material or weave design as a function of material pliability, strength and toughness. (e.g., Spider Silk, Woven Metal Fibers).
  - Integrate impact energy distribution and dissipation into the material structure itself.

Sniper Detection

- Enhance capability of sniper detection systems especially in crowded environments where the public brings various optical systems.
  - Retroreflection Systems
    - High speed processing of high resolution images across a wide spectral band to characterize and discriminate between retroreflection signals from optical systems to support quick identification of threat.
    - Change detection or other cueing options to aid search.
  - Alternative concepts for detecting presence of weapons at a distance.

Blast Effects and Mitigation

- Efficiently identify vulnerabilities and weak points in new construction design phase and analysis of existing structures providing cost-effective mitigation retrofit options.
  - New construction materials to harden structures against collapse and reduce risks from flying glass and other materials.
  - Low cost instrumentation and re analysis of high rise buildings to of imminent collapse.
  - Survivable escape route designs
  - Shock wave dissipating features



Discussion

- How can we better formulate requirements, communicate and work together with the national/international scientific community to meet the continuing challenge?